

# The First Record of the Genus *Eogammarus* (Crustacea: Amphipoda: Anisogammaridae) from Korea

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## ABSTRACT

An anisogammarid amphipod, *Eogammarus possjeticus* (Tzvetkova, 1967), is newly recorded from Jindo Island, Korea, with a detailed description and illustrations. The species belonging to the genus *Eogammarus* are sharing several plesiomorphic characteristics, so they are similar to each other. However, *Eogammarus possjeticus* can be discriminated from congeners by the following characters combined: appendages are not fossorial, setations of antennae are weak, and the number and position of robust setae on pleonal epimera, urosomes, and telson are different from its congeners. This is the first record of the genus *Eogammarus* Birstein, 1933 from Korean waters.

**Keywords:** amphipod, anisogammarid, *Eogammarus possjeticus*, new record, taxonomy, Korea

## INTRODUCTION

The genus *Eogammarus* Birstein, 1933 belonging to family Anisogammaridae Bousfield, 1977 was erected by Birstein (1933) based on the following three species placed in the genus *Gammarus* Fabricius, 1775: *G. kygi* Derzhavin, 1923, *G. schmidtii* Derzhavin, 1927, and *G. suifunensis* Martynov, 1925. This genus was re-ranked as a subgenus of genus *Anisogammarus* Derzhavin, 1927 by Schellenberg (1937). Bousfield (1979) revised the family Anisogammaridae and elevated *Eogammarus* to generic rank to include 10 species (Bousfield, 1979). Recently, Tomikawa et al. (2006) reviewed the genus *Eogammarus* with the first record of a new species, *E. itotomikoe* Tomikawa et al., 2006, and redescribed eight valid species of the genus except *E. ryotoensis* (Uéno, 1940) and *E. turgimanus* (Shen, 1955). By the study of Tomikawa et al. (2006), *E. sinensis* Ren, 1992 from the Yellow Sea was synonymized as *E. possjeticus* (Tzvetkova, 1967). Up to date, the following 11 valid species in the genus *Eogammarus* have been recorded from North Pacific: *E. barbatus* (Tzvetkova, 1965), *E. confervicolus* (Stimpson, 1856), *E. itotomikoe*, *E. kygi* (Derzhavin, 1923), *E. oclairi* Bousfield, 1979, *E. possjeticus*, *E. psammophilus* Bousfield, 1979, *E. ryotoensis*, *E. schmidtii* (Derzhavin, 1927),

*E. tiuschovi* (Derzhavin, 1927), and *E. turgimanus* (Stimpson, 1856; Derzhavin, 1923, 1927; Uéno, 1940; Shen, 1955; Tzvetkova, 1965, 1967; Bousfield, 1979; Tomikawa et al., 2006). However, genus *Eogammarus* has not been recorded from Korean fauna yet. Here, *E. possjeticus* belonging to genus *Eogammarus* is first reported from Korea, with a detailed description and illustrations.

## MATERIALS AND METHODS

Materials examined in this study were collected from intertidal zone by washing algae using a sieve. Specimens were initially fixed with 85% ethyl alcohol and preserved with 99% ethyl alcohol after sorting in the laboratory. Their appendages were dissected in a petri dish or on a hole slide glass filled with glycerol using a dissection pincer and a needle under a stereomicroscope (M205C; Leica, Wetzlar, Germany). They were mounted as temporary or permanent slides using lactophenol solution. Drawings were performed with a drawing tube connected a light microscope (DM2500; Leica). Definition of term for 'seta' and its types follows those of Watling (1989). Materials were deposited in the National Institute of Biological Resources (NIBR), Incheon, Korea.

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## SYSTEMATIC ACCOUNTS

Order Amphipoda Latreille, 1816  
Suborder Senticaudata Lowry and Myers, 2013  
Family Anisogammaridae Bousfield, 1977  
<sup>1</sup>\*Genus *Eogammarus* Birstein, 1933

<sup>2</sup>\**Eogammarus possjeticus* (Tzvetkova, 1967)  
(Figs. 1–8)

*Anisogammarus* (*Eogammarus*) *possjeticus* Tzvetkova, 1967: 176, figs. 5–7; 1972: 214; 1975: 109, figs. 40–42.

*Eogammarus possjeticus* Bousfield, 1979: 312; Hirayama and Takeuchi, 1993: 156, figs. 12–14; Tomikawa et al., 2006: 1131, figs. 30–32.

*Eogammarus sinensis* Ren, 1992: 307, figs. 12, 13; 2006: 250, fig. 98.

**Material examined.** 4♂, Korea: Jeollanam-do, Jindo-gun, Gunnae-myeon, Na-ri, Ganeunmok (34°34'02"N, 126°14'44"E), 27 Jul 2016, from intertidal zone by washing algae using a sieve, Kim JG, cat No. NIBRIV0000760221-NIBRIV0000760224.

**Description. Male:** Body (Fig. 1) about 14.8 mm long in dissected specimen.

Head (Fig. 2A), rostrum weak; lateral cephalic lobe oblique, weakly produced apically; antennal sinus deep; eye reniform, well-developed.

Antenna 1 (Fig. 2B) slightly longer than antenna 2, with length ratio of 1.00 : 0.61 : 0.31 in peduncular articles 1–3; peduncular article 1 stout, anterodistal corner produced with 1 seta; accessory flagellum 6-articulate, distal article reduced; flagellum composed of more than 23 articles.

Antenna 2 (Fig. 2C), peduncular article 1 with 1 cluster of 3 short setae posterodistally; peduncular articles 2–3 with robust setae anteriorly; peduncular article 5 0.95 times as long as article 4; flagellum 12-articulate, 0.85 times as long as peduncular article 4–5 combined, with calceoli from 1st to 7th articles anterodistally, distal article reduced.

Upper lip (Fig. 2D) subtriangular in dorsal view, covered with apical and subapical fine setae.

Lower lip (Fig. 2E), inner lobe minute; outer lobe apically round with 8 robust bifid setae; mandibular process developed bearing round apex.

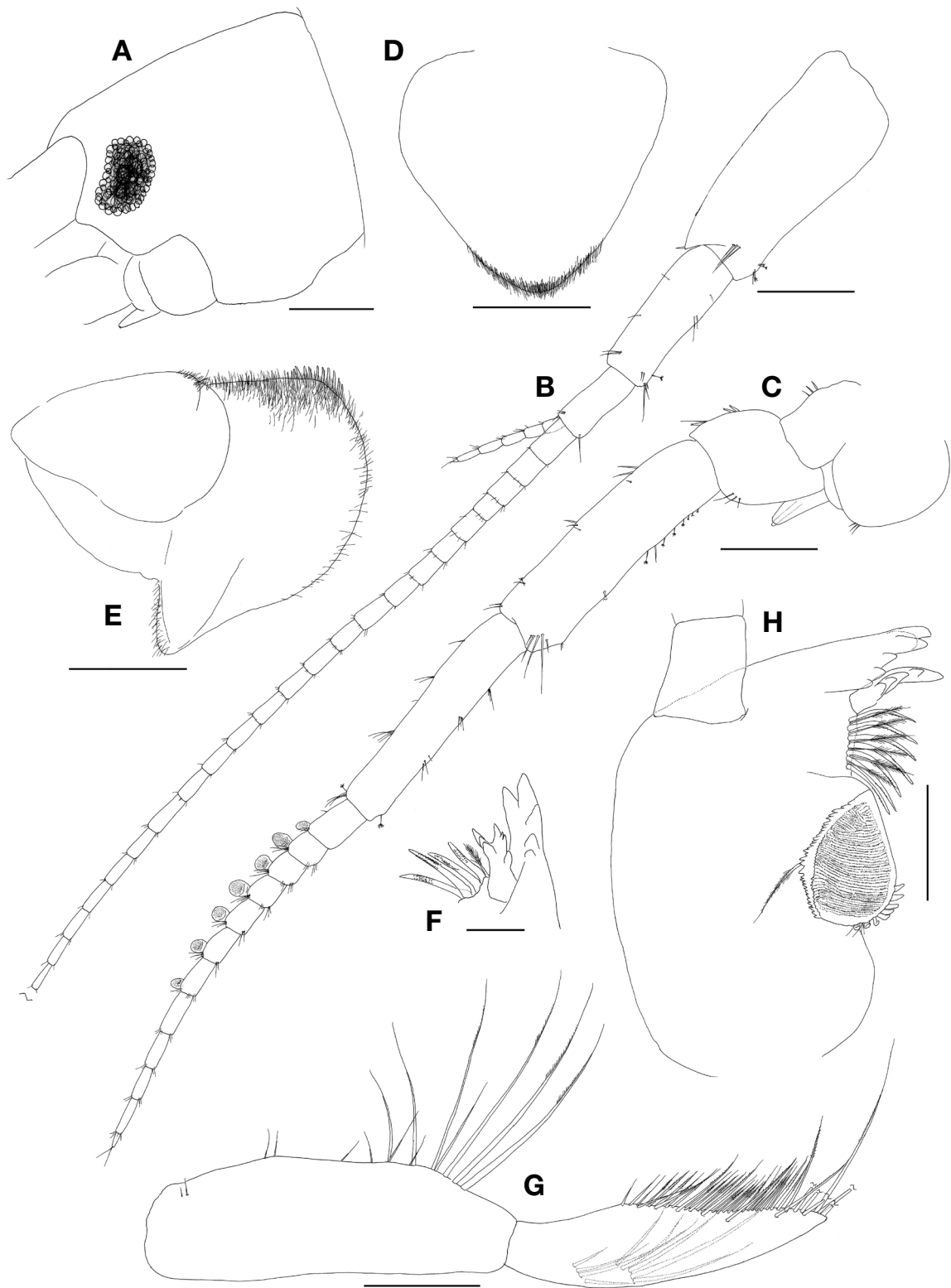
Right mandible (Fig. 2F, G) with 5-dentate incisor and trifid lacinia mobilis (2 of 3-dentate and 1 tooth), accessory setal row composed of 1 plumose seta and 4 serrate setae; palp article 2 as long as article 3 and extended medially, article 3 falcate, with numerous setae on distal 2/3 of medial margin and 2 rows of facial setae. Left mandible (Fig. 2H) with 6-dentate incisor and 5-dentate lacinia mobilis, accessory setal row composed of 6 plumose setae and 7 serrate setae in turn; molar triturative, columnar, with 1 plumose seta.

Maxilla 1 (Fig. 3A–C), inner plate subrectangular, slightly extended mediodistally, with 17 plumose setae medially;



**Fig. 1.** *Eogammarus possjeticus* (Tzvetkova), male. Habitus, lateral. Scale bar = 2.0 mm.

Korean name: <sup>1</sup>\*뎡은손옆새우속 (신칭), <sup>2</sup>\*뎡은손옆새우 (신칭)



**Fig. 2.** *Eogammarus possjeticus* (Tzvetkova), male. A, Head; B, Antenna 1; C, Antenna 2; D, Upper lip; E, Lower lip; F, Incisor and lacinia mobilis of right mandible; G, Palp of right mandible; H, Left mandible. Scale bars: A=0.5 mm, B, C=1.0 mm, D, E, G, H=0.2 mm, F=0.1 mm.

outer plate with 11 toothed robust setae apically; palp bi-articulate, distal article slightly swollen with 3 plumose setae midlaterally, with 8 robust setae apically and 1 row of 8 simple setae submarginally.

Maxilla 2 (Fig. 3D), inner plate with marginal and submarginal setae apically and 1 oblique row of 13 plumose setae; outer plate slightly larger than inner plate, with marginal and submarginal setae apically.

Maxilliped (Fig. 3E–G), inner plate rectangular, with 4 robust and 6 plumose setae apically, with 6 serrate setae on surface distally, medial margin with 8 plumose setae; outer plate subovoid, with 18 serrate and 4 plumose setae marginally; palp article 2 longest, with numerous setae medially, article 3 curved, with 1 serrate robust seta at laterodistal corner, article 4 falcate, 0.51 times as long as article 3, apical spine robust, 0.39 times as long as article 4.

Gnathopod 1 (Fig. 4A, B), coxa rectangular, 0.64 times wider than long, with 12 setae ventrally (most robust in posterodistal seta); basis trapezoidal (angulate at proximal 1/4 of posterior margin), as long as coxa, anterior margin with 3 elongate and 2 short setae proximally and 1 short seta subdistally, posterior margin with 5 elongate setae, with 1 cluster of 3 serrate and 2 simple setae at posterodistal corner; ischium with developed anterior lobe; merus with 5 clusters of simple setae; carpus as long as merus, with developed posterior lobe distally bearing 10 setae; propodus stout, subrectangular, as long as coxa, anterior margin convex with 2 setae, posterior margin with 4 clusters of short setae, palm nearly vertical, lined with 10 lateral and 10 medial peg-setae; dactylus falcate, with blunt protrusion near hinge.

Gnathopod 2 (Figs. 4C–E, 5A) subsimilar to gnathopod 1; coxa subrectangular, anteroventral margin slightly extended and round, with 20 short setae ventrally (most robust in posterodistal seta); coxal gill enlarged, with 2 accessory lobes near basal part; basis trapezoidal, as long as coxa, with 10 setae anteriorly and 11 elongate setae posteriorly, with 1 cluster of 3 serrate and 3 simple setae at posterodistal corner; carpus with 1 seta and 1 cluster of 4 setae anteriorly, carpal lobe larger than that of gnathopod 1, with several clusters of many setae; propodus slightly smaller than that of gnathopod 1, subrectangular, with 5 clusters of setae on posterior margin, palm nearly vertical, lined with 9 lateral and 7 medial peg-setae, with 1 cluster of 3 serrate setae at each mediobasal and laterodistal corner; dactylus falcate, with blunt protrusion near hinge.

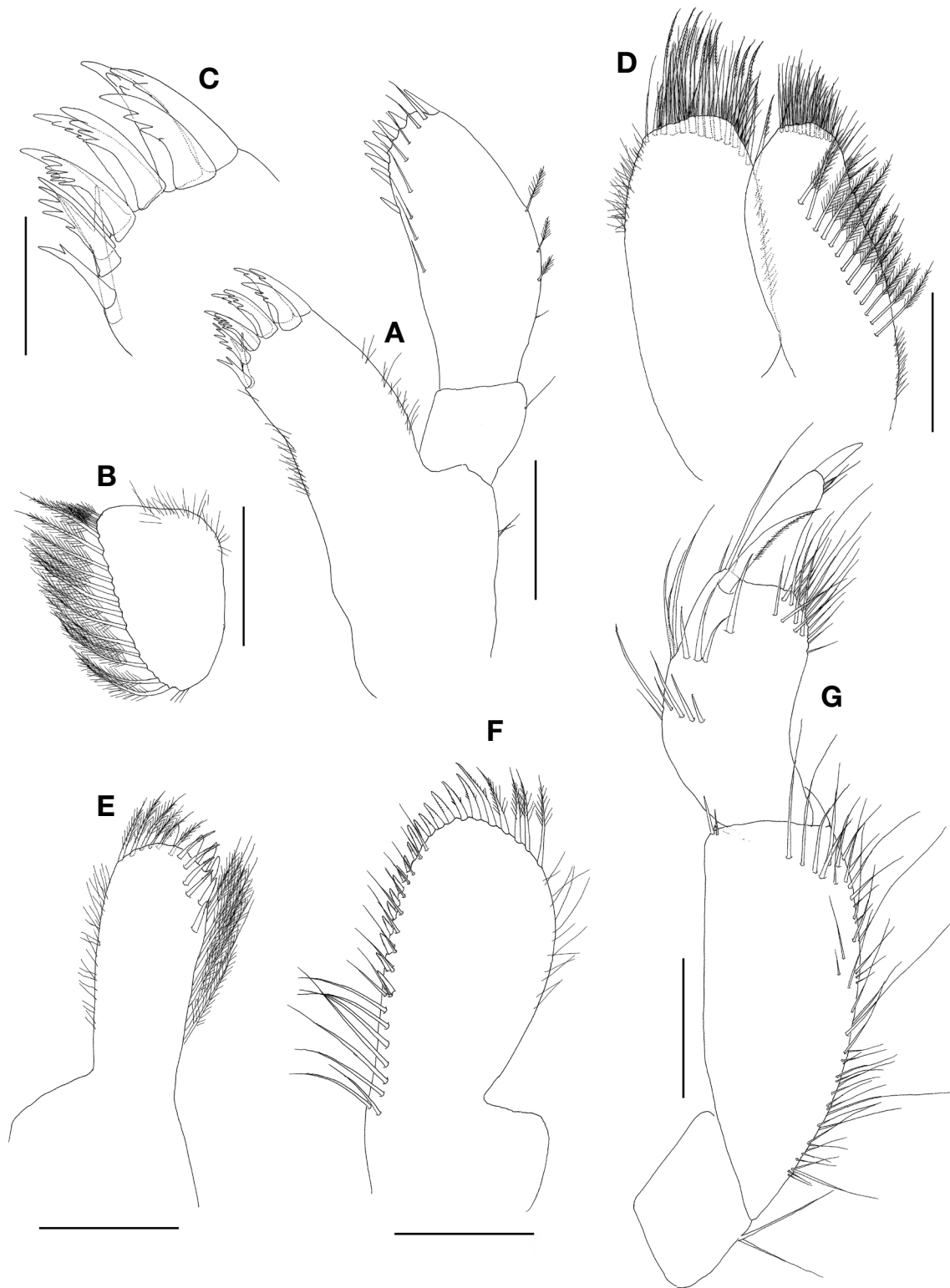
Pereopod 3 (Fig. 5B–D), coxa slightly extended backwards distally, anterior distal corner round, with 20 setae ventrally (most robust in posterodistal seta); coxal gill subovoid, slender than that of gnathopod 2, with 2 accessory lobes near basal part; basis slightly curved, as long as coxa, anterior margin with 2 clusters of elongate setae and 2 pairs of short

setae on proximal half, with 1 stout seta and 1 pair of medial setae at angulate anterodistal corner, posterior margin with 12 elongate setae, with 1 cluster of 4 setae at posterodistal corner; merus slightly extended anteriorly, anterior margin with 2 clusters of 1 robust seta and 2 short setae, anterodistal corner produced with 1 cluster of 1 robust seta and 6 short setae apically, posterior margin with 2 clusters of 1 robust and 1 short seta, with 1 robust seta and 4 short setae at posterodistal corner; carpus rectangular, 0.83 times as long as merus, distal margin oblique with robust setae; propodus linear, 0.76 times as long as merus; dactylus falcate, 0.44 times as long as propodus.

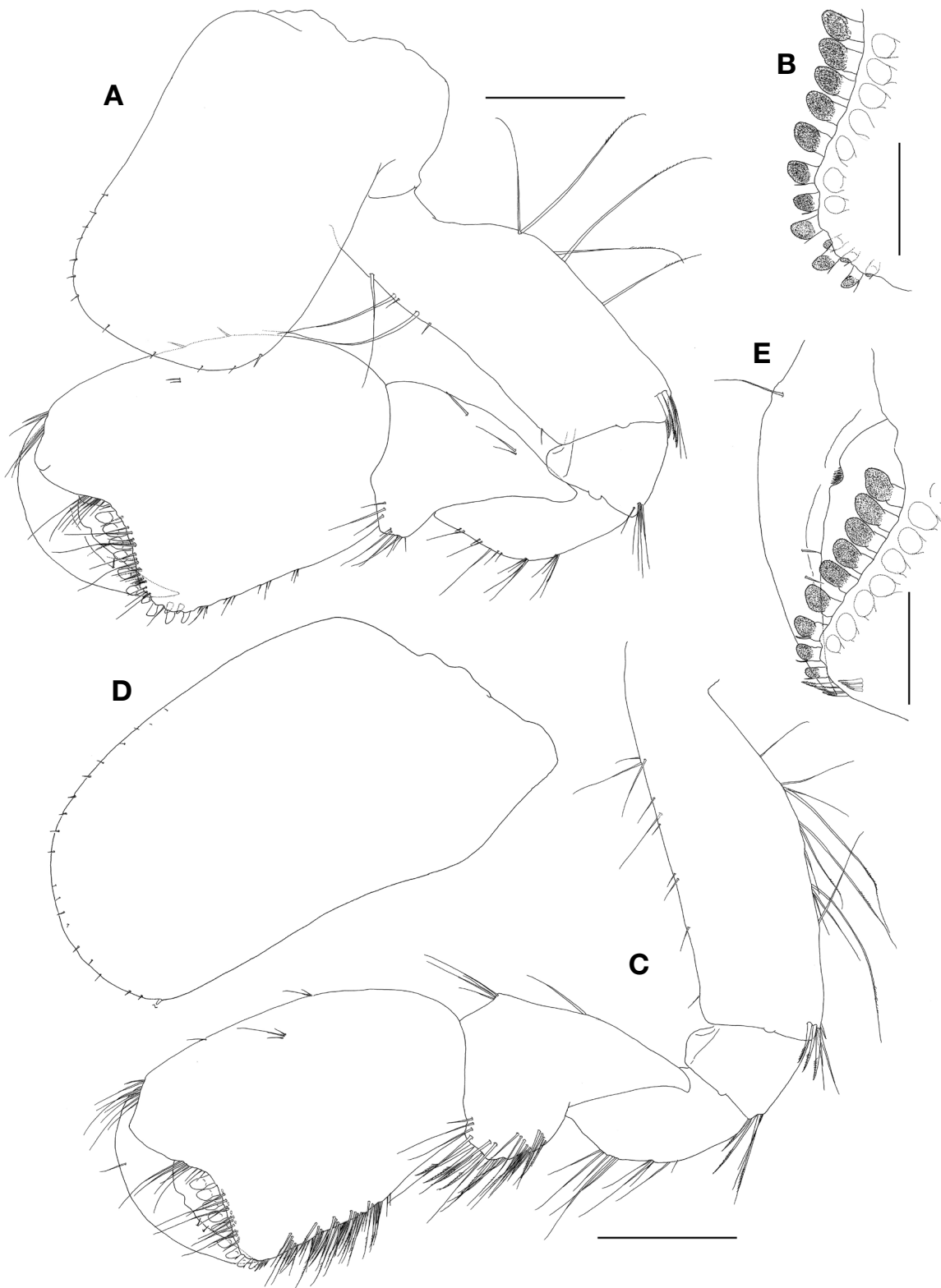
Pereopod 4 (Fig. 5E–G) subsimilar to pereopod 3; coxa extended backwards, with 26 setae ventrally; coxal gill slender than that of pereopod 3; basis, anterodistal protrusion more produced; merus and carpus slightly shorter than those of pereopod 3.

Pereopod 5 (Fig. 6A, B), coxa bilobate, shallow, posterior lobe larger than anterior lobe, with 2 stout setae ventrally and 1 small notch bearing 1 short seta; coxal gill moderate, with 2 accessory lobes near basal part; basis, anterior margin convex, with 4 long setae and 4 clusters of robust setae, posterior margin slightly extended, concave at distal 2/3, with 13 short setae marginally; merus slightly extended posteriorly with 2 clusters of robust and short setae, anterodistal corner with 1 cluster of 1 robust seta and 2 short setae, posterodistal corner weakly produced with 1 cluster of 1 minute seta and 2 robust setae; carpus rectangular, 0.95 times as long as merus, with 2 clusters of robust setae on anterior and posterior margins, respectively, with 4 simple and 2 robust setae at anterodistal corner and 5 robust setae at posterodistal corner; propodus linear, 1.08 times as long as carpus, posterior margin with 4 clusters of robust and simple setae and 1 pair of locking setae distally, anterior margin with 1 minute seta and 1 cluster of elongate and simple setae, with 1 cluster of elongate and simple setae at anterodistal corner; dactylus falcate, unguis, with 1 inner and 1 facial simple setae.

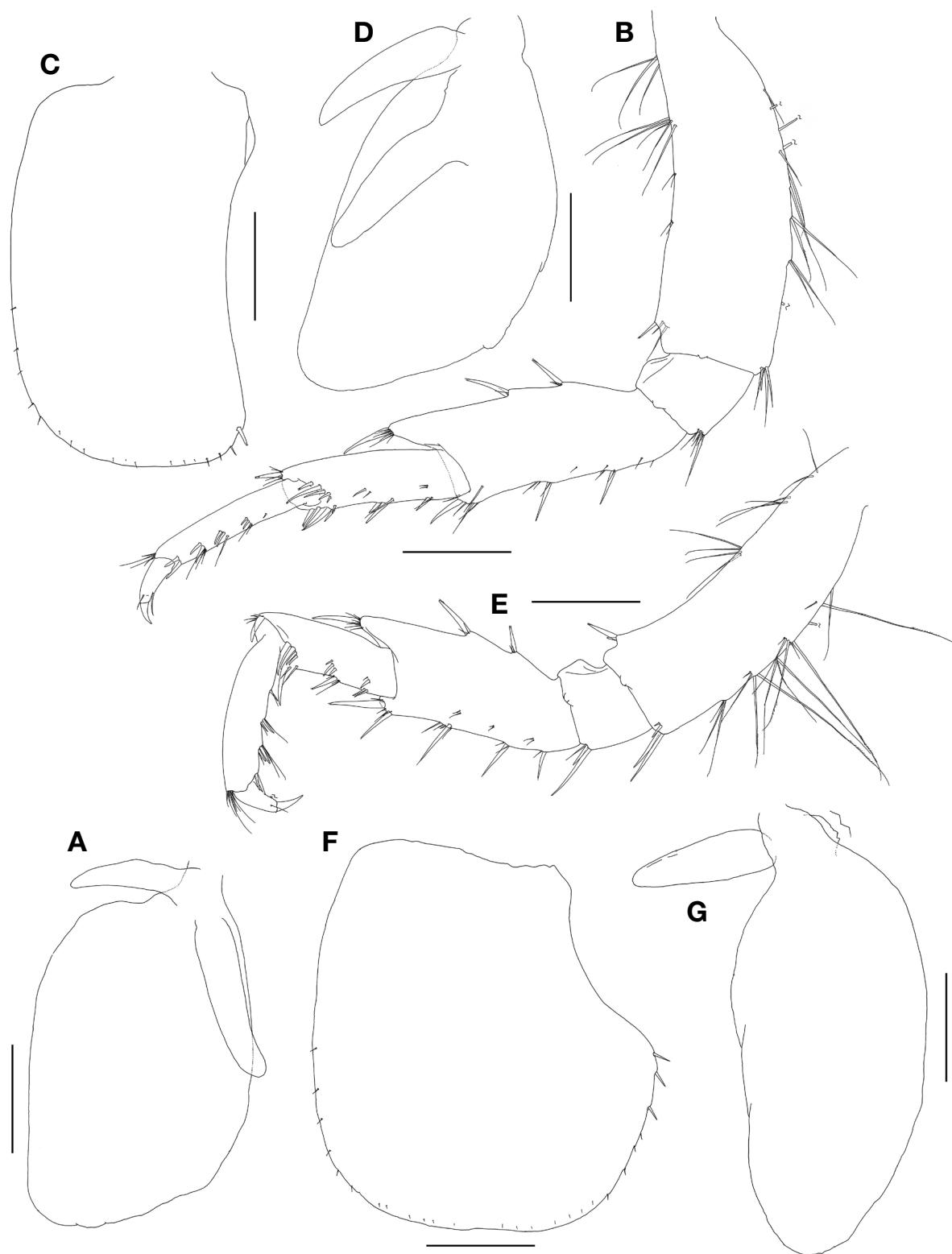
Pereopod 6 (Fig. 6C, D), coxa bilobate, not deep, anterior lobe small, with 3 long setae anteriorly, posterior lobe with 3 robust setae ventrally and 1 small notch bearing 1 short seta; coxal gill moderate, with 2 accessory lobes near basal part; basis larger than that of pereopod 5, anterior margin convex, with 3 clusters of simple setae proximally and 5 clusters of robust setae, posterior margin extended, concave at distal 2/3, with 14 short setae marginally and 1 pair of setae at posterodistal corner; merus slightly extended posteriorly, posterior margin with 1 cluster of robust setae, posterodistal corner weakly produced with 1 cluster of 4 robust setae, anterodistal corner with 1 cluster of 4 robust and 1 short setae; carpus rectangular, 1.10 times as long as merus, with 3 and



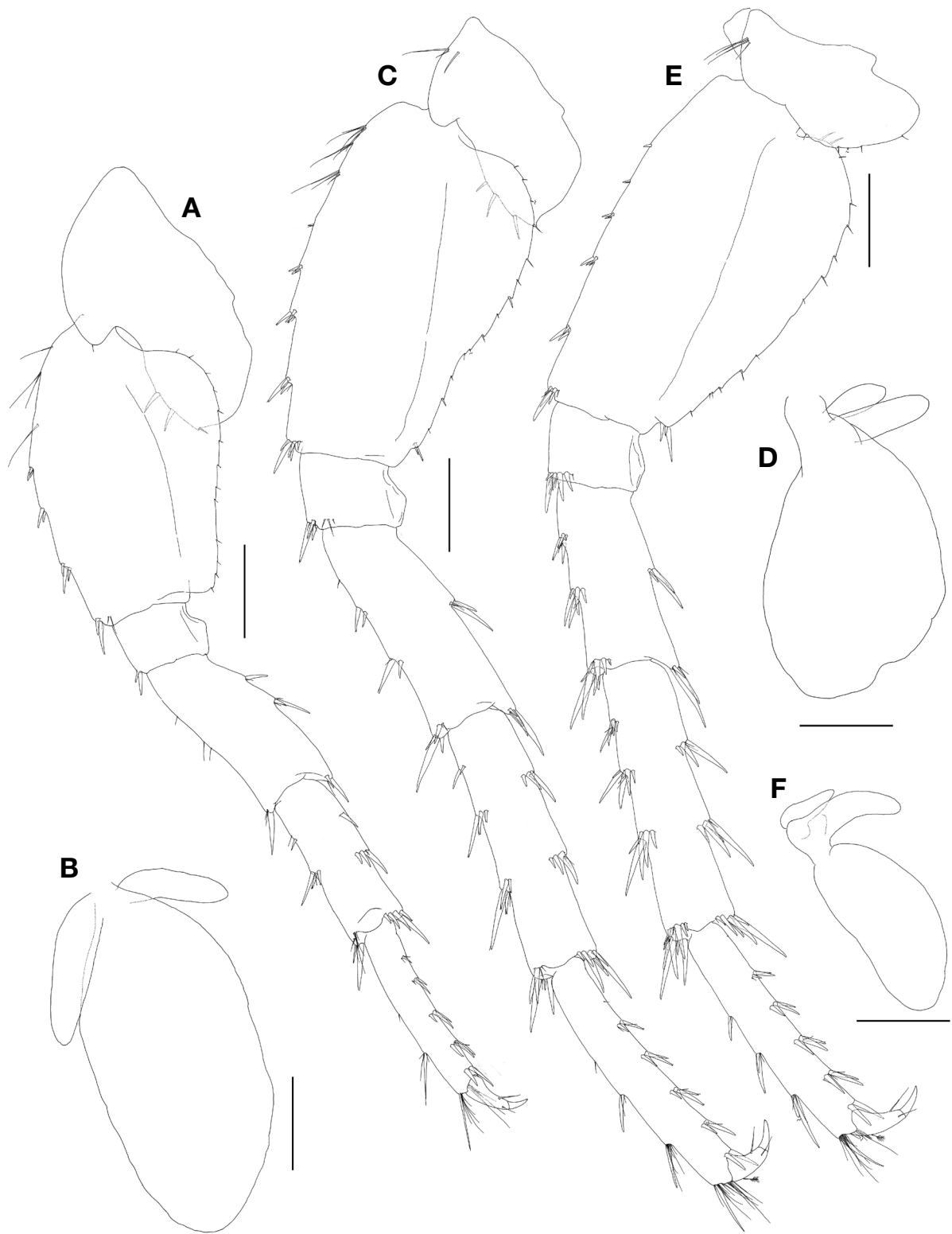
**Fig. 3.** *Eogammarus possjeticus* (Tzvetkova), male. A, Maxilla 1; B, Inner plate of maxilla 1; C, Apical spines on outer plate of maxilla 1; D, Maxilla 2; E, Inner plate of maxilliped; F, Outer plate of maxilliped; G, Palp of maxilliped. Scale bars: A, B, D-G=0.2 mm, C=0.1 mm.



**Fig. 4.** *Eogammarus possjeticus* (Tzvetkova), male. A, Gnathopod 1; B, Peg-setae on palmer margin of gnathopod 1; C, Gnathopod 2; D, Coxa 2; E, Peg-setae on palmer margin of gnathopod 2. Scale bars: A, C, D=0.5 mm, B, E=0.2 mm.



**Fig. 5.** *Eogammarus possjeticus* (Tzvetkova), male. A, Coxal gill of gnathopod 2; B, Pereopod 3; C, Coxa 3; D, Coxal gill of pereopod 3; E, Pereopod 4; F, Coxa 4; G, Coxal gill of pereopod 4. Scale bars: A-G=0.5 mm.



**Fig. 6.** *Eogammarus possjeticus* (Tzvetkova), male. A, Pereopod 5; B, Coxal gill of pereopod 5; C, Pereopod 6; D, Coxal gill of pereopod 6; E, Pereopod 7; F, Coxal gill of pereopod 7. Scale bars: A-F=0.5 mm.



2 clusters of robust setae on anterior and posterior margins, respectively, with 3 simple and 5 robust setae at anterodistal corner and 7 robust setae at posterodistal corner; propodus linear, as long as carpus, posterior margin with 4 clusters of robust and simple setae and 1 pair of locking setae distally, anterior margin with 1 minute seta and 2 clusters of elongate and simple setae, anterodistal corner with 1 cluster of elongate and simple setae; dactylus falcate, unguis, with 1 inner and 1 facial simple setae.

Pereopod 7 (Fig. 6E, F) as long as pereopod 6; coxa unilobate, with minute notch midventrally, with 1 cluster of 4 long setae anteriorly and 6 short marginal setae posteroventrally; basis, expanded posterior margin without concavity; other articles similar to those of pereopod 6 except for stronger setation.

Pleonites (Fig. 7A) with low keels dorsally; pleonal epimera with simple setae anteroventrally and oblique ledges on surface, with 1 short seta posteriorly; epimeron 2 with additional ledge bearing 2 facial setae, with 3 setae ventrally; epimeron 3 with 5 setae ventrally.

Pleopod 1 (Fig. 7B, C), peduncle slightly tapered distally, with 3 clusters of plumose setae distolaterally and 1 cluster of 2 retinacular and 3 plumose setae distomedially; inner and outer rami 23- and 26-articulate, respectively.

Pleopod 2 (Fig. 7D, E): subsimilar to pleopod 1; inner and outer rami 22- and 25-articulate, respectively.

Pleopod 3 (Fig. 7F, G): 0.91 times as long as pleopod 2; inner and outer rami 19- and 22-articulate, respectively.

Urosomites 1–3 (Figs. 7A, 8A) with 4–2–4 clusters of setae from urosomites 1 to 3 dorsodistally; urosomites 1–2 with keels dorsally.

Uropod 1 (Fig. 8B), peduncle with 5 lateral (1 distal, 1 subdistal and 3 marginal) and 3 medial (1 subdistal and 2 marginal) robust setae dorsally, with 1 basofacial robust seta lateroproximally; rami linear, 0.83 times as long as peduncle, outer ramus with 2 lateral and 3 medial robust setae dorsally, with 4 robust setae apically; inner ramus as long as outer ramus, with 1 lateral and 4 medial robust setae dorsally, with 4 robust setae apically.

Uropod 2 (Fig. 8C) 0.60 times as long as uropod 1; peduncle with 3 lateral (1 subdistal and 2 marginal) and 2 medial (1 subdistal and 1 marginal) robust setae; outer ramus 0.69 times as long as peduncle, with 2 lateral robust setae dorsally and 4 robust setae apically; inner ramus 1.44 times as long as outer ramus, with 1 lateral and 2 medial robust setae dorsally, with 5 robust setae apically.

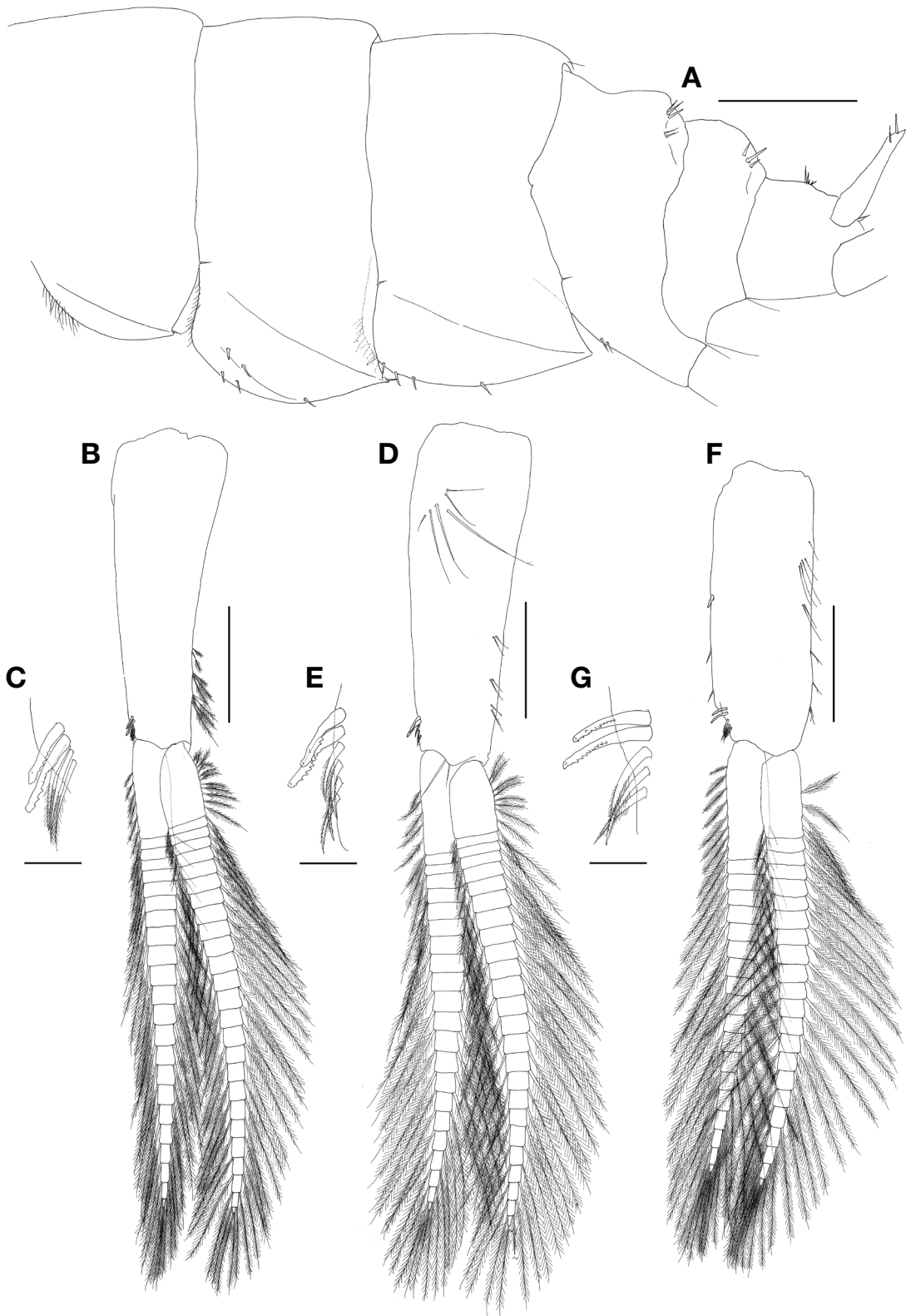
Uropod 3 (Fig. 8D) 0.78 times as long as uropod 1, peduncle 0.69 times as long as that of uropod 2, with 1 seta on medial margin, with 1 cluster of 4 medial and 1 cluster of 3 lateral robust setae distally; inner ramus 0.33 times as long as outer ramus, with 3 setae medially and 1 cluster of 3 se-

tae apically; outer ramus 2.60 times as long as peduncle, bi-articulate, with 5 clusters of simple and robust setae laterally, lined with plumose and robust setae medially, distolateral and distomedial corners with 1 cluster of robust and simple setae, respectively, distal article 0.17 times as long as proximal article, with 1 cluster of setae apically.

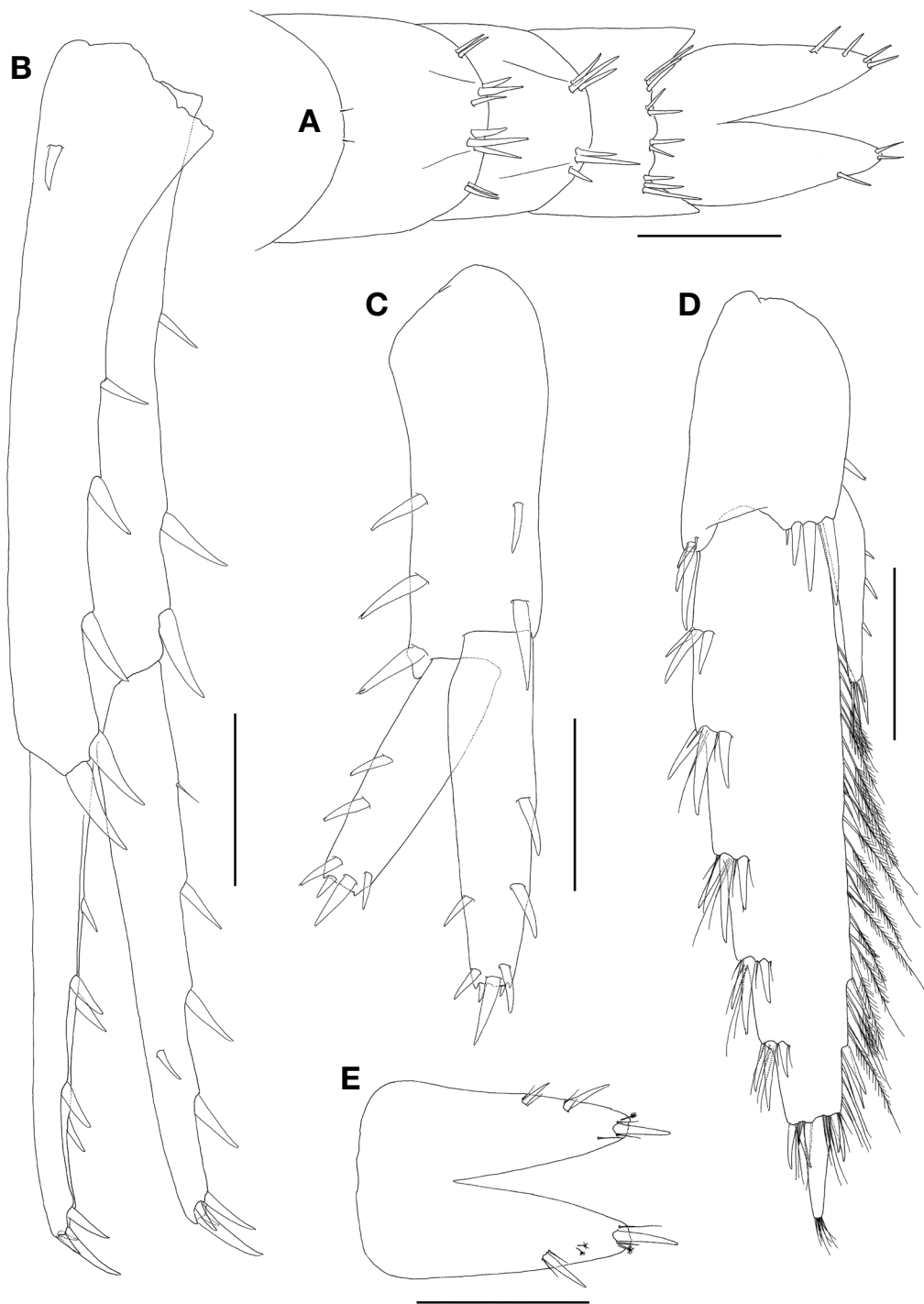
Telson (Fig. 8E) 0.78 times wider than long, cleft distally (0.65 times of total length), with 1 cluster of 1 robust, 1 simple and 1 plumose seta apically, with 1 or 2 distolateral clusters of robust and simple setae.

**Female:** Unknown from Korea.

**Remarks.** Bousfield (1979) recognized the following three subgroups in the genus *Eogammarus* Birstein, 1933: (1) “fossorial-complex” with subequal antennae, setose coxae and appendages, strongly expanded basis of pereopod 7, and strongly plumose inner margin of outer ramus on uropod 3 [including *E. barbatus* (Tzvetkova, 1965), *E. itotomikoa* Tomikawa et al., 2006, *E. kygi* (Derzhavin, 1923), *E. psammophilus* Bousfield, 1979 and *E. schmidt* (Derzhavin, 1927)]; (2) “not fossorial-complex” with less setose appendages, less expanded basis of pereopod 7, and larger peg-setae on male gnathopods [including *E. confervicolus* (Stimpson, 1856), *E. oclairi* Bousfield, 1979, *E. possjeticus* (Tzvetkova, 1967) and *E. tiuschovi* (Derzhavin, 1927)]; and (3) “*E. ryotoensis* (Uéno, 1940)-complex” with dissimilar male gnathopods and a unique combination of dorsal spine clusters in urosomites. Among the subgroup of “not fossorial-complex”, *E. possjeticus* can be readily distinguished from *E. tiuschovi* as follows: (1) the basis on pereopod 7 is the broadest at proximal 1/3 in *E. possjeticus* (vs. the broadest distally in *E. tiuschovi*); (2) both pleonal epimera 2 and 3 show only one seta on posterior margin in *E. possjeticus* (vs. six to ten setae in *E. tiuschovi*); and (3) the telson possesses apical and lateral robust setae in *E. possjeticus* (vs. only apical setae in *E. tiuschovi*) (Derzhavin, 1927; Bousfield, 1979; Tomikawa et al., 2006). *Eogammarus possjeticus* can be discriminated from *E. confervicolus* and *E. oclairi* by the following features: (1) the posterior margin of peduncular article 1 on antenna 1 has only simple setae posterodistally (vs. one robust seta at posterodistal corner and two clusters of setae on posterior margin in *E. confervicolus* and *E. oclairi*); and (2) the clusters of lateral setae in dorsodistal margin of urosomite 1 are composed of one or two robust setae in *E. possjeticus* (vs. at least three robust setae in *E. confervicolus* and *E. oclairi*) (Stimpson, 1856; Bousfield, 1979; Tomikawa et al., 2006). In this respect, the Korean *Eogammarus* specimens examined in this study can be readily assigned as *E. possjeticus* (Tzvetkova, 1967). However, the following minor differences are found between our Korean materials and the original description by Tzvetkova (1967): (1) the accessory flagellum is 6-articulate in Korean materials (vs. 5-articulate in the



**Fig. 7.** *Eogammarus possjeticus* (Tzvetkova), male. A, Pleonites and urosomites, lateral; B, Pleopod 1; C, Retinacular and plumose setae on pleopod 1; D, Pleopod 2; E, Retinacular and plumose setae on pleopod 2; F, Pleopod 3; G, Retinacular and plumose setae on pleopod 3. Scale bars: A=0.1 mm, B, D, F=0.5 mm, C, E, G=0.05 mm.



**Fig. 8.** *Eogammarus possjeticus* (Tzvetkova), male. A, Urosomites, dorsal; B, Uropod 1; C, Uropod 2; D, Uropod 3; E, Telson. Scale bars: A-E=0.5 mm.

original description); (2) the mandibular palp article 2 is more expanded in Korean materials; (3) the incisor of right mandible is 5-dentate in Korean materials (vs. 4-dentate in

the original description); (4) there are one row of setae along the mediodistal margin of palp article 2 on maxilla 1 in Korean materials (vs. absent in the original description); (5) the

number of apical setae of inner plate on maxilla 1 is 11 in Korean materials (vs. eight in the original description); and (6) the outer ramus of uropod 3 has five clusters of robust setae laterally in Korean materials (vs. four clusters in the original description) (Tzvetkova, 1967). The significance of these minor differences mentioned above needs to be further studied.

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